Hirschegg 2006 Highlights

Grant Logan

HIFS-VNL Weekly Physics Meeting
February 27, 2006

26th International Workshop on High Energy Density in Matter at Hirschegg, Austria
January 29 to February 3, 2006

Conference Chairman: Markus Roth GSI-TU Darmstadt, Germany

(Copies of my Foreign Travel Trip report available upon request to Lynn Heimbucher)

The Hirschegg Conferences are organized like Gordon Conferences, with morning and evening sessions, afternoons free.

Informal:

No proceedings published

Encourage discussions

History: The German laboratory Gesellschaft fur Schwerionenforschung mbH (Center for heavy-ion beam research) and the nearby Technical University of Darmstadt have jointly sponsored the Hirschegg series of international conferences on high energy density in matter for the past 26 years, held in the Waldemar-Peterson-Haus, a small retreat/conference center owned by the TU Darmstadt for the last 60 years. Beginning 26 years ago with about 45 participants, mostly European, on the physics of heavy ion beam driven inertial fusion, the conference now has about 100 participants from all over the world-Europe, Russia, US, and Japan, now concentrating on the physics of high energy density in matter driven by intense ion beams and now short pulse lasers, with a particular focus on high density, moderate temperature (1 to few eV) strongly coupled plasmas (Warm Dense Matter-WDM).

View from the hill where the conference is held.

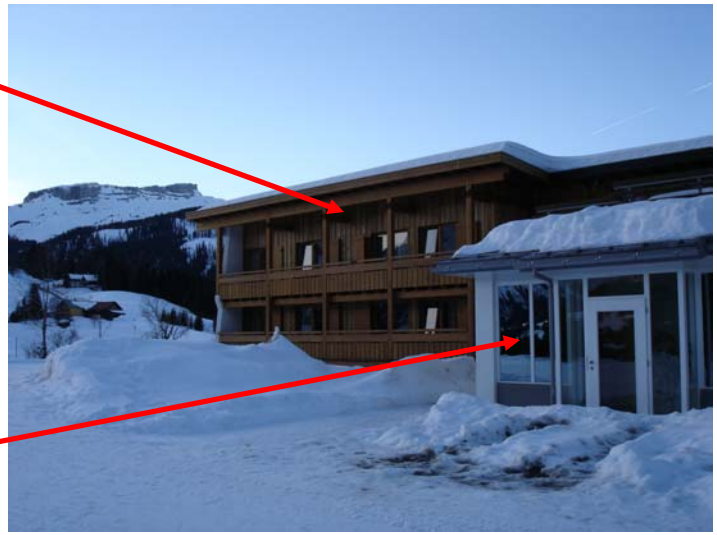
"Hirschegg" translates to "deer area"

The Waldemar-Petersen Haus is both a boarding house as well as small conference center

New dorm extension

Dining room of the old boarding house

Remodeled conference room expanded from 45 to 100 capacity



Hirschegg speakers must be captivating to avoid the distraction of surroundings!

The Hirschegg 2006 program illustrates both a variety of HEDP/WDM topics as well as broad international science community participation

Programme

	Monday 30.01.2006		Tuesday 31.01.2006		Wednesday 01.02.2006		Thursday 02.02.2006		Friday 03.02.2006
8:45	B. Sharkov (25+5) Physical issues of the proton radiography	8:45	A. Ulrich (25+5) Particle beam induced light sources and lasers	8:45	M. Hegelich (25+5) Ion driven Fast Ignition	8:45	S. Gordienko (25+5) Skin-layer phenomena in laser-overdense plasma interaction	8:45	A. Bret (25+5) Electromagnetic instabilities in a density gradient for Fast Ignition
9:15	V. Fortov (25+5) Electronic Transformation of Matter at High Energy Density	9:15	S. Glenzer (25+5) Progress in Laser Plasma Interactions at High Electron Temperatures (25+5)	9:15	M. Geissel (25+5) Latest Results of Z and the Z-Beamlet Shortpulse Upgrade	9:15	K. Ledingham (25+5) Recent Results on Laser Induced Electron and Ion Acceleration	9:15	J. Stein (25+5) Strong magnetic fields, filamentation and fast igntion
9:45	R. Piriz (15+5) Rayleigh-Taylor instability in accelerated solid slabs	9:45	D. Fisher (15+5) Ions in solid density plasmas	9:45	M. Schollmeier (15+5) Influence of non-gaussian laser beam profile on proton acceleratio	9:45	An Tauschwitz (15+5) Hydrodynamic calculations of	9:45	T. Baeva (15+5) Ultrarelativistic spikes and HHG at plasma
10:05	Coffee Break								
10:30	J. Meyer-ter Vehn On Bubble acceleration (tutorial)	10:30	G. Logan (25+5) Advances in U.S. heavy-ion fusion science	10:30	A. Pukhov (25+5) Theory and simulations of relativistic laser-plasmas	10:30	R. Ramis (25+5) Simulation of imploding cylindrical targets	10:30	N. Andreev (25+5) Superstrong plasma fields and radiation under the Action of Short Intense Laser Pulses
11:00	E. Brambrink Target heating in	11:00	D. Varentsov (15+5) HEDP experiments	11:00	D. Gericke (15+5) Temperature	11:00	T. Schlegel (15+5) Laser heated	11:00	N. Inogamov (15+5) Ultrashort

Hirschegg often includes tutorials like Fortov's .... and graduate students like this one

My presentation to the WDM Conference in Pleasanton, CA Feb 23 was ~ this Hirschegg talk

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	short pulse laser plasma interaction (15+5)		with intense heavy ion beams at GSI and at FAIR		Relaxation in Dense Shock-produced Plasmas		hohlraums for heavy ion stopping and opacity measurements		laser pulse ablation at moderate intensities
11:20	J. Honrubia (15+5) Fast electron energy deposition in precompressed DT targets	11:20	L Drska (15+5) Laboratory Nuclear Astrophysics with HED Facilities: A Chance or Dream ?	11:20	C. Deutsch (15+5) Low velocity ion stopping in connection with the US program	11:20	V. Efremov (15+5) Behavior of condensed and porous targets under pulse energy fluxes	11:20	A. Kietzmann (15+5) QMD Simulations for Fluid Alkali Metals
11:40	K. Flippo (15+5) Laser Accelerated Heavy Ions Using Laser Ablation Cleaning	11:40	K. Witte (15+5) PHELIX in 2006	11:40	B. Jacob (15+5) WPMD Simulation of Dense Hydrogen with full Antisymmetrisatio n	11:40	O. Rosmej (15+5) Projectile ion charge and velocity dynamics in solid and gaseous matter	11:40	M. Veysman (15+5)
12:00	B. Rethfeld (15+5) Ultrashort dynamics of laser-excited solids	12:00	G. Schaumann (15+5) Energy loss of heavy ions in plasma, indirectly heated by laser driven Hohlraum radiation	12:00	I. Tkachenko (15+5) Interaction of HED plasmas with radiation: method of moments	12:00	V. Turtikov (15+5) Heavy Ion Beam Pumped Excimer Laser Experiment	12:00	
12:30	Lunch Break								
	Afternoon Session								
17:00	B. Holst (25+5) EOS of dense hydrogen and phase transitions	17:00	A. Tronnier (25+5) Absorption of VUV photons in solids	17:00	Poster Session	17:00	K. Weyrich (25+5) Energy loss of Heavy Ions in Ar-plasma and Ar-gas in the Gap-target	17:00	

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					Configuration		
17:30	P. Ni (25+5) Recent HEDP/WDM Experiments with intense heavy ion beams at GSI	17:30	S. Toleikis (25+5) First experiments at the VUV-FEL / DESY		17:30	T. Toma (25+5) Ultrafast laser driven micro-lens to focus MeV protons	17:30
18:00	D.Semkat (15+5) Dynamic collision frequency in warm dense aluminum	18:00	L. Cao (15+5) High Resolution VUV Spectrometer with High Sensitivity for VUV FEL Plasma Diagnostics		18:00	A. Pelka (15+5) Spatially resolved measurement of the electron density in laser produced plasmas	18:00
18:20	N. Tahir (15+5) An Overview of High Energy Density Research at Future FAIR Facility	18:20	A. Hoell (15+5) Proposal for a First Pump and Probe Thomson Scattering Experiment at the DESY VUV-FEL		18:20	S. Korostiy (15+5) Spectroscopic investigations of the heavy ion charge dynamics in solid and gaseous target	18:20
18:40	D. Ursescu (15+5) Prospects for a sub 10 nm wavelength x-ray laser at PHELIX	18:40	C. Fortmann (15+5) Bremsstrahlung vs. Thomson scattering in VUV-FEL plasma experiments	19:00	18:40	G. Rodriguez Prieto (15+5) Highly Asymmetric Ions in Medium Flux Plasmas: Spectroscopic and Space Resolved Studies	18:40
19:00	Dinner Time						

ELECTCTRONIC TRANSFORMATIONS OF MATER AT HIGH ENERGY DENSITIES (tutorial)

Vladimir Fortov *Institute for High Energy Densities, RAS*

We (Lynn) have Fortov's talk in powerpoint for anyone who requests

Matter at High Energy Densities

Generations and Diagnostics

Metallizations

Plasma Phase Transitions

Dielectrizations

Rarefaction Waves

Quantum Monte-Carlo

INTERACTION AND QUANTUM EFFECTS IN DENSE PLASMAS (Fortov)

 # Coulomb interaction

$W_c \sim Z^2 e^2 n^{1/3}$

 # strong coupling, if $\Gamma = \frac{W_c}{W_{th}} \geq 1$

— Nonideality boundary:

$< U_{Coul} >=< E_{Kin} >$

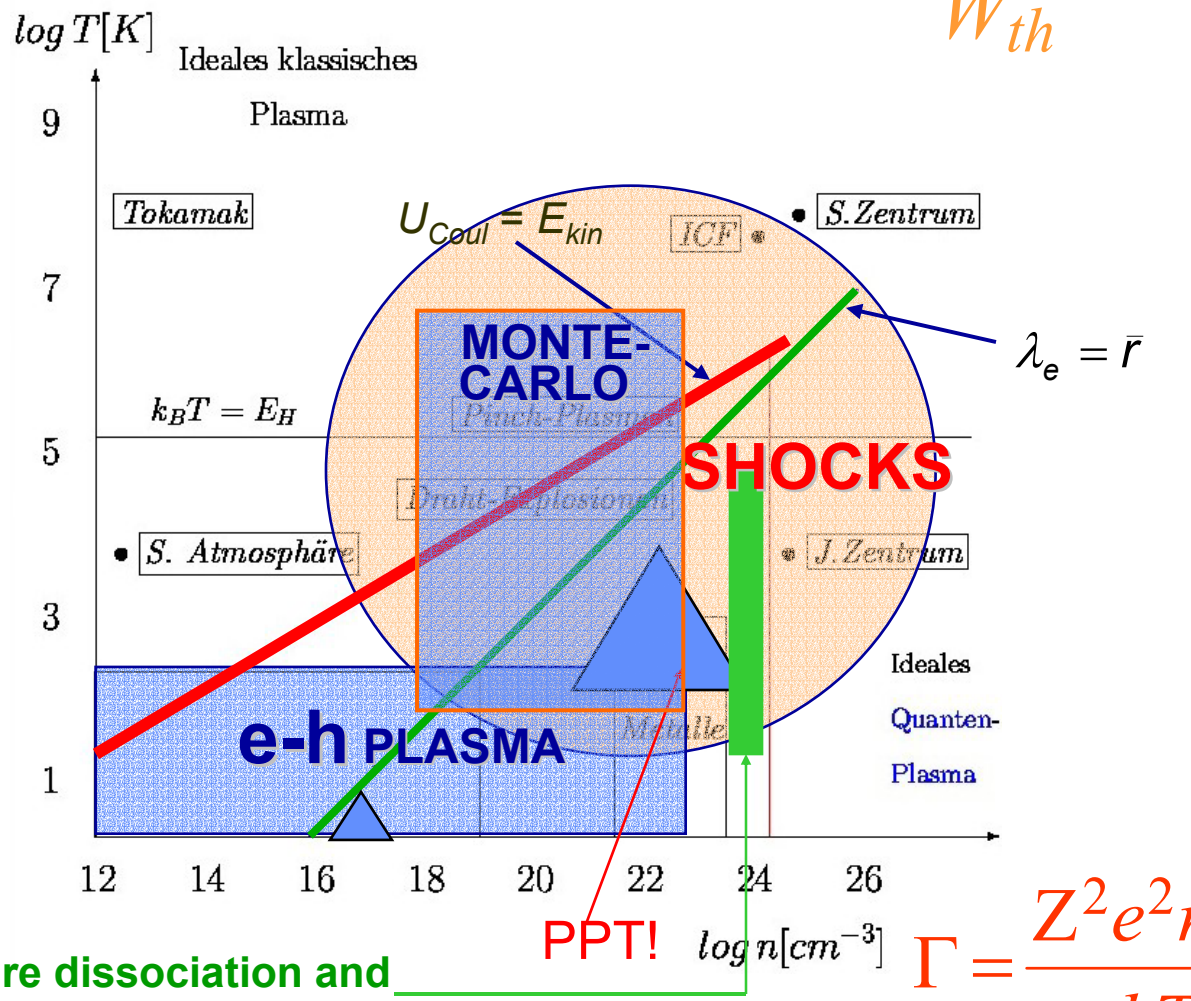
—

 # Statistics:

$n\lambda^3 << 1 \quad W_{th} \sim kT$

$n\lambda_e^3 \sim 1 \quad W_{th} = \hbar^2 n^{2/3}/2m$

$\lambda_e = \bar{r}$



$\Gamma = \frac{Z^2 e^2 n^{1/3}}{kT}$

Pressure dissociation and ionization, Mott effect

Low velocity ion stopping of relevance to the US beam-target program

•C. DEUTSCH and G. MAYNARD

•LPGP

•Université Paris-Sud, Orsay, France

PHEMD 2006 Workshop

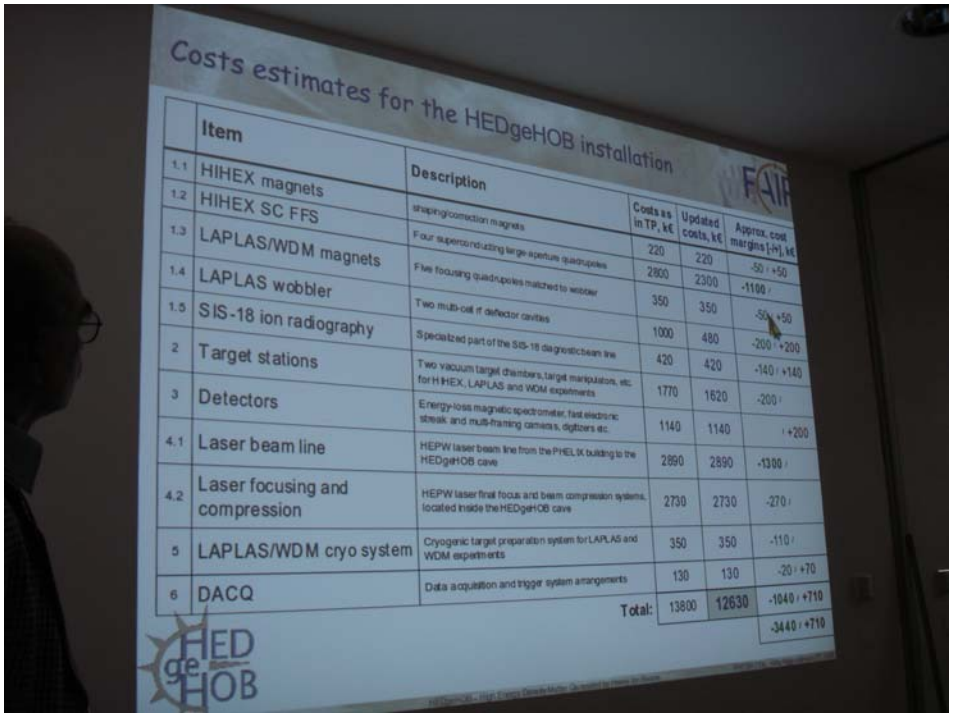
HIRSCHEGG, Jan. 29 - Feb.03 2006

(Proposed by C. Deutsch) Further inquiries:

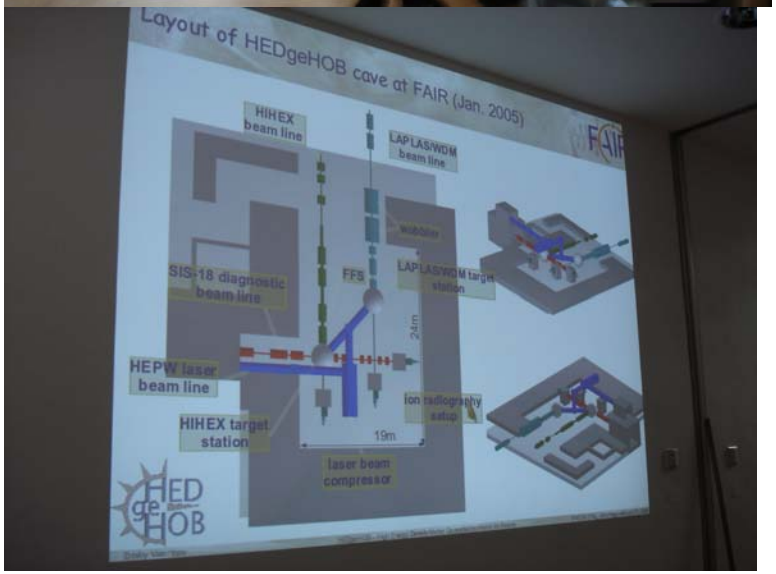
- Projectile effective charge near end of range
- Inflight projectile spectroscopy
- Strong Coulomb correlations in target → WDM
- Ion multiple scattering and straggling
- Superelastic contribution to low V_p ion stopping
- Validation of global sum rule for arbitrary ion beam distribution
- Projectile excitation (Z projectile > Z target)

→Claude Deutsch told me he very much wants to collaborate with the HIFS-VNL on these topics. (Grant) I told him I very much encourage such collaboration! –volunteers?

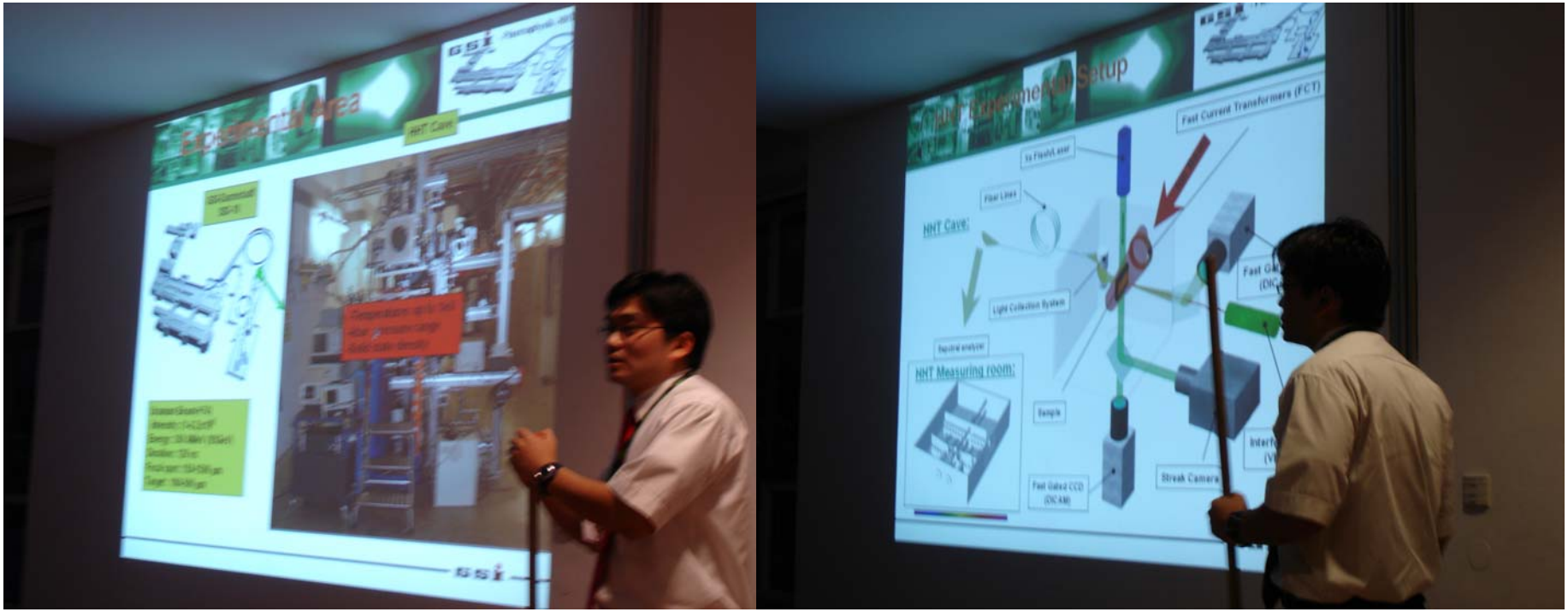
Dimitri Varentsov updated plans for WDM area of the GSI upgrade project FAIR



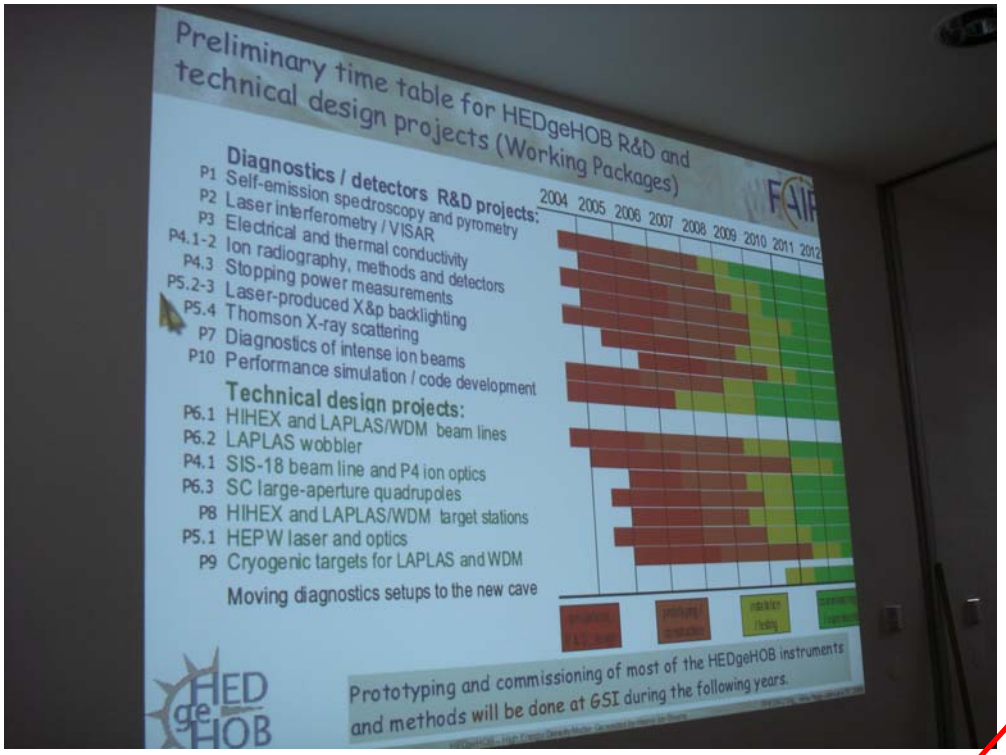
	Item	Description	Costs as in TP, k€	Updated costs, k€	Approx. cost margins [-/+], k€
1.1	HIHEX magnets	shaping/correction magnets	220	220	-50 / +50
1.2	HIHEX SC FFS	Four superconducting large-aperture quadrupoles	2800	2300	-1100 /
1.3	LAPLAS/WDM magnets	Five focusing quadrupoles matched to wobbler	350	350	-50/ +50
1.4	LAPLAS wobbler	Two multi-cell rf deflector cavities	1000	480	-200 / +200
1.5	SIS-18 ion radiography	Specialized part of the SIS-18 diagnostic beam line	420	420	-140 / +140
2	Target stations	Two vacuum target chambers, target manipulators, etc. for HIHEX, LAPLAS and WDM experiments	1770	1620	-200 /
3	Detectors	Energy-loss magnetic spectrometer, fast electronic streak and multi-framing cameras, digitizers etc.	1140	1140	/ +200
4.1	Laser beam line	HEPW laser beam line from the PHELIX building to the HEDgeHOB cave	2890	2890	-1300 /
4.2	Laser focusing and compression	HEPW laser final focus and beam compression systems, located inside the HEDgeHOB cave	2730	2730	-270 /
5	LAPLAS/WDM cryo system	Cryogenic target preparation system for LAPLAS and WDM experiments	350	350	-110 /
6	DACQ	Data acquisition and trigger system arrangements	130	130	-20 / +70
		Total:	13800	12630	-1040 / +710
					-3440 / +710

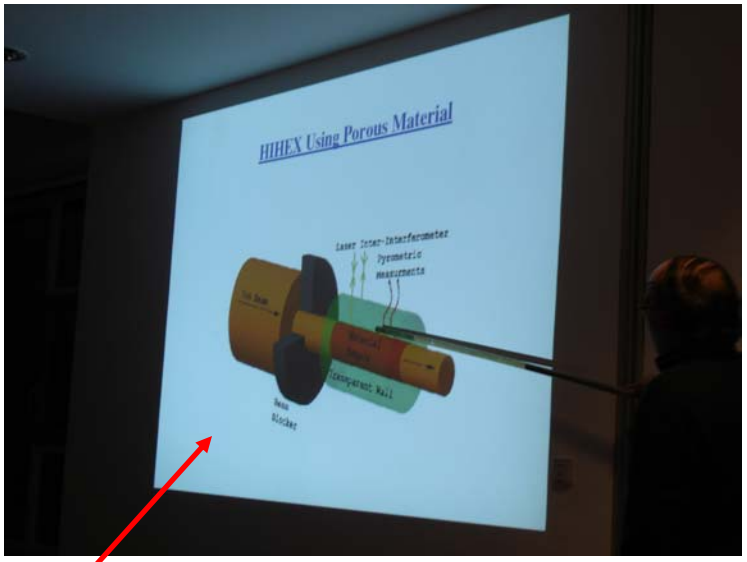


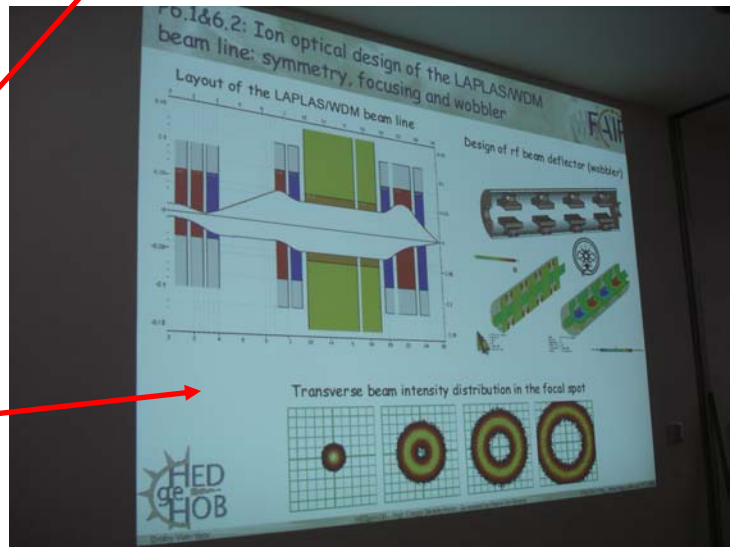
Pavel Ni is eager to collaborate with VNL (Bieniosek) on joint development of WDM diagnostics



Naeem Tahir wants to collaborate comparing his hydo/WDM codes with those used by the VNL for various WDM experiments

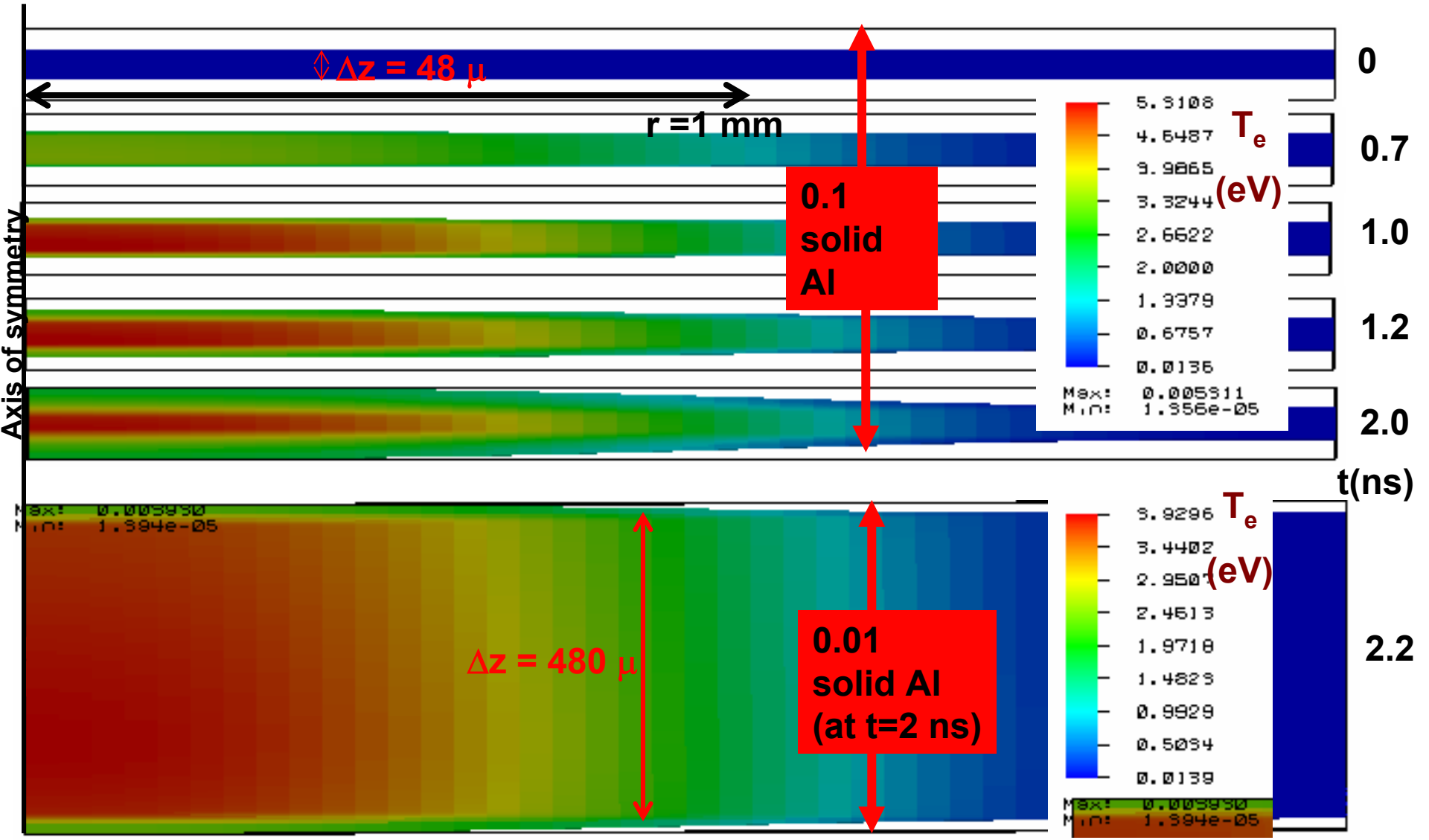






- GSI schedule
- HIHEX exp with porous media
- RF-cavity wobbler to modulate beam deposition profile (can be used for NDCX-II RT study w/ion DD

Hydra simulations (2-D) confirm temperature uniformity of targets at 0.1 and 0.01 times solid density of aluminum (NDCX-II, 24 MeV Na^+)

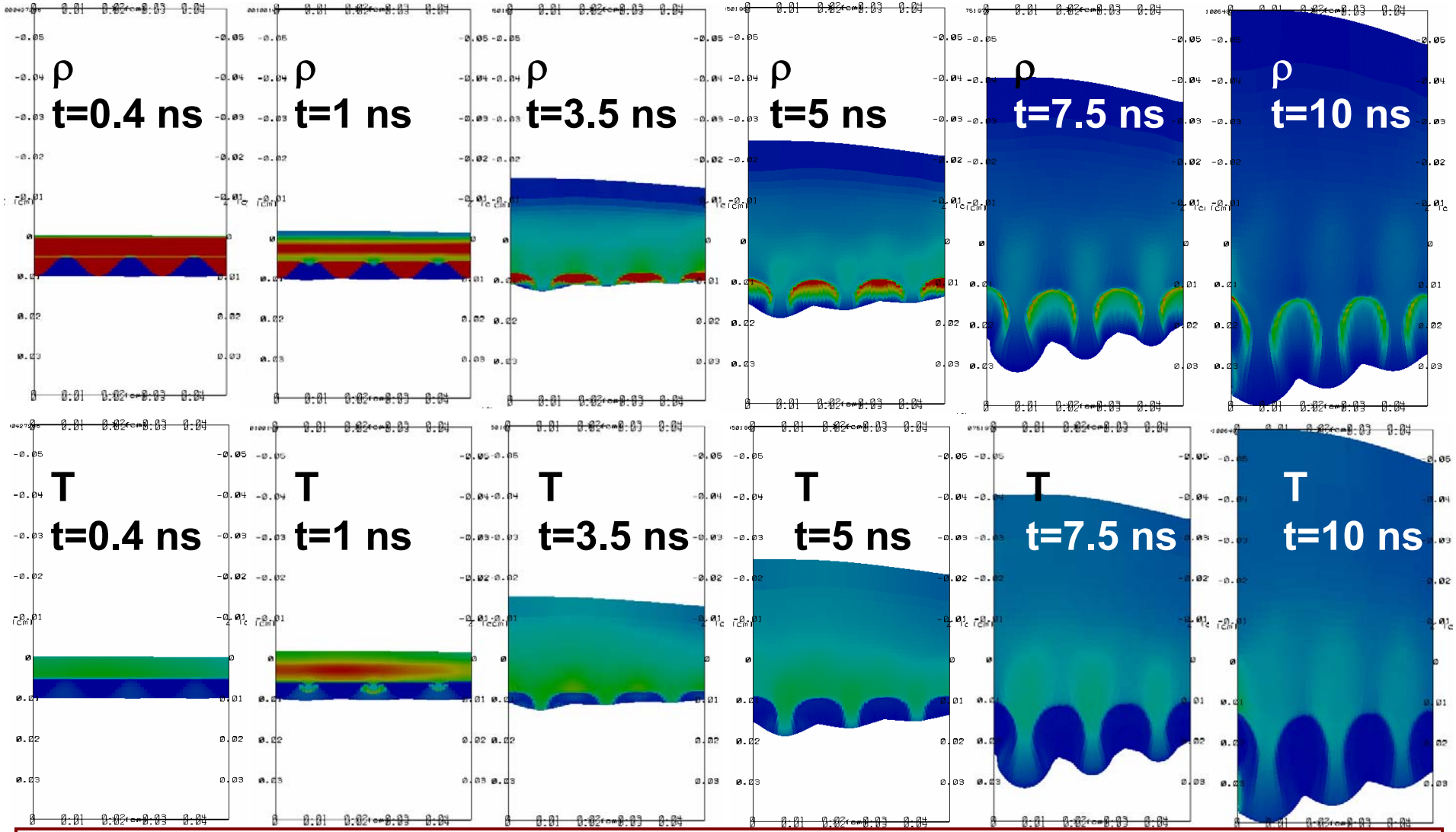


Proposed HIFS-VNL collaborative experiment at GSI

Opportunities for experimental collaboration

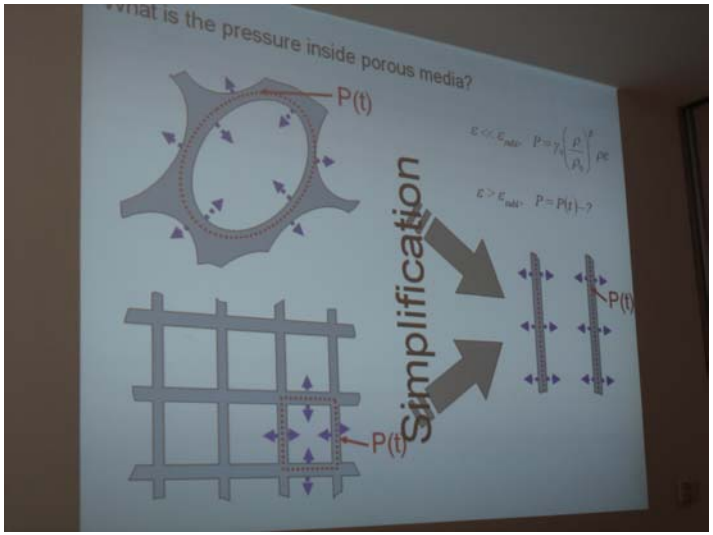
- **Foams are of interest to HIFS-VNL and others:**
  - **Extend range of low energy heavy ion beams to reduce hydro expansion time**
  - **Study issues of relaxation and homogenization as filaments expand into voids**
  - **Foams are also of interest in heavy-ion IFE targets**
- **Proposed experiment uses metal foams (~10-30% solid density metal) to study effect of pore size using dE/dx and other diagnostics:**
  - **initial experiments can be done non-destructively at low intensity; later experiments in WDM regime.**
- **GSI is equipped to make these measurements at existing facility**

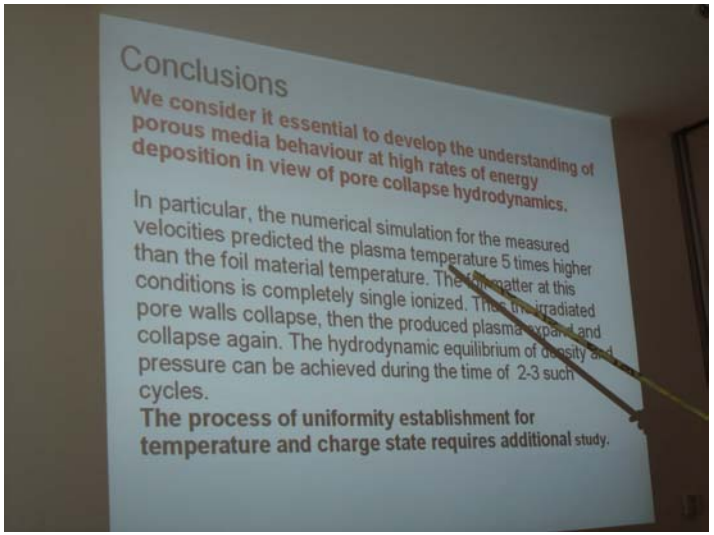
When initial surface ripple is applied, beam-driven Rayleigh-Taylor growth is seen. [Kawata (Japan) proposes stabilization by GHz beam modulation].



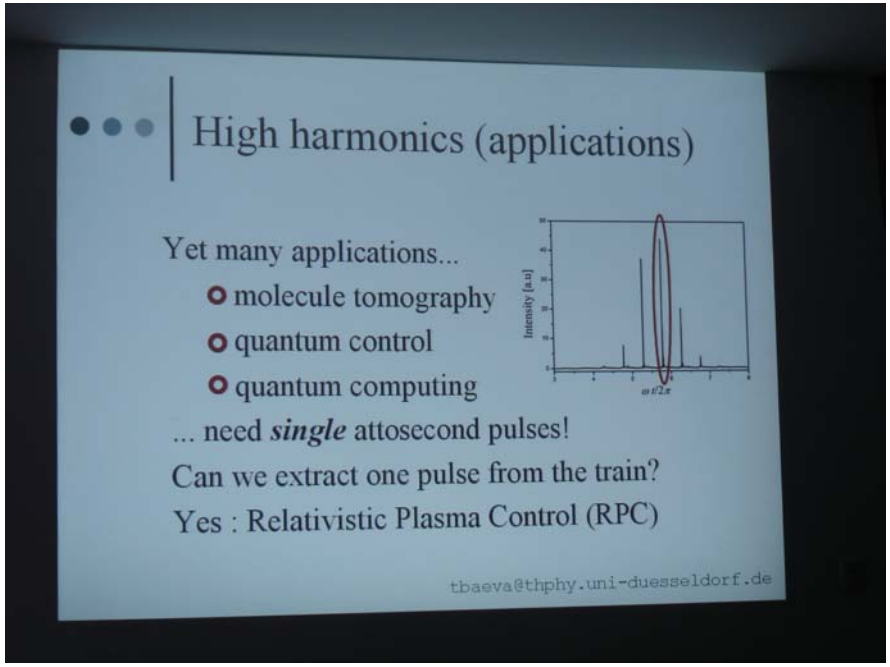
Tahir and Deutsch want to evaluate use of a wobbler to stabilize ion driven RT!

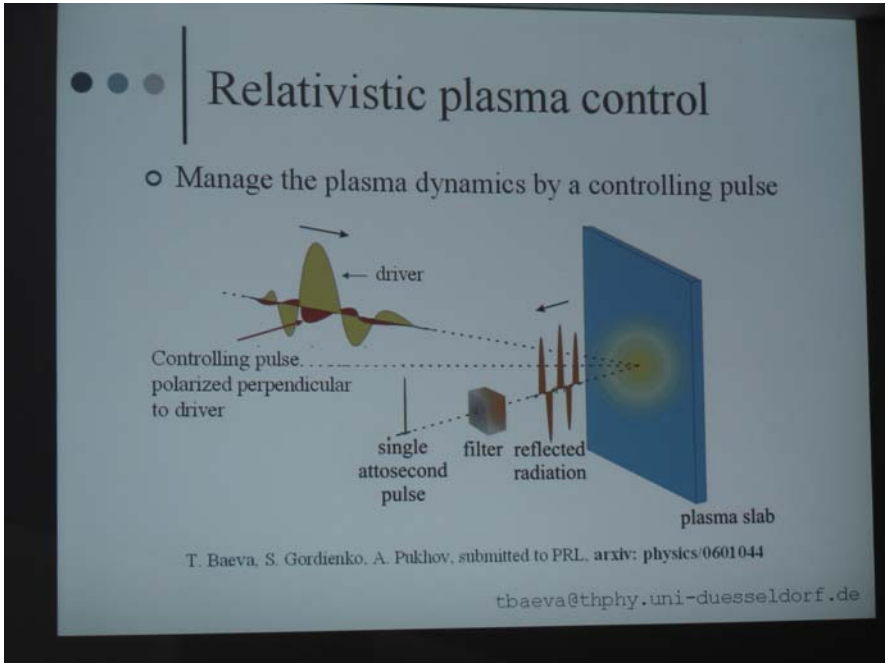
Vladimir Efremov (IHED Institute, RAS Moscow) wants to collaborate on homogenization/EOS for porous media.





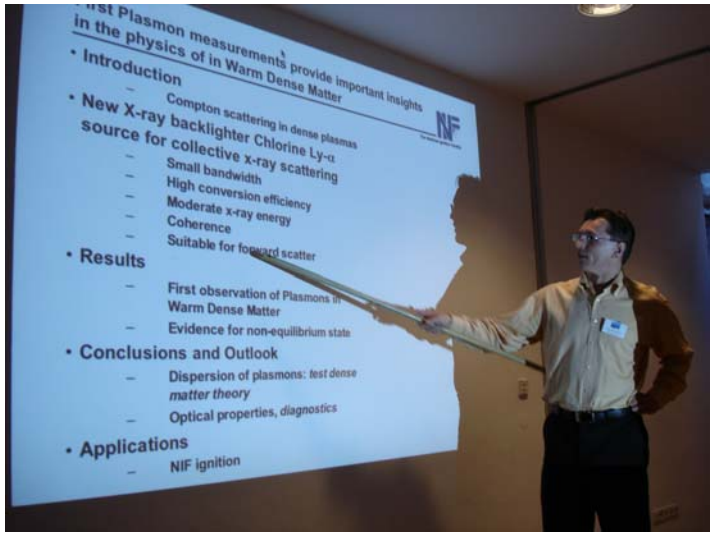
Single attosecond EUV pulses are pursued in Europe using reflection of high harmonics of ultra short pulse lasers

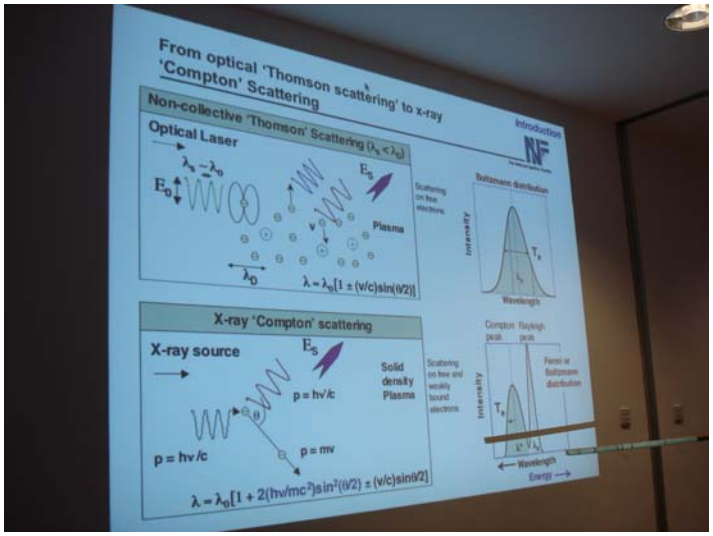


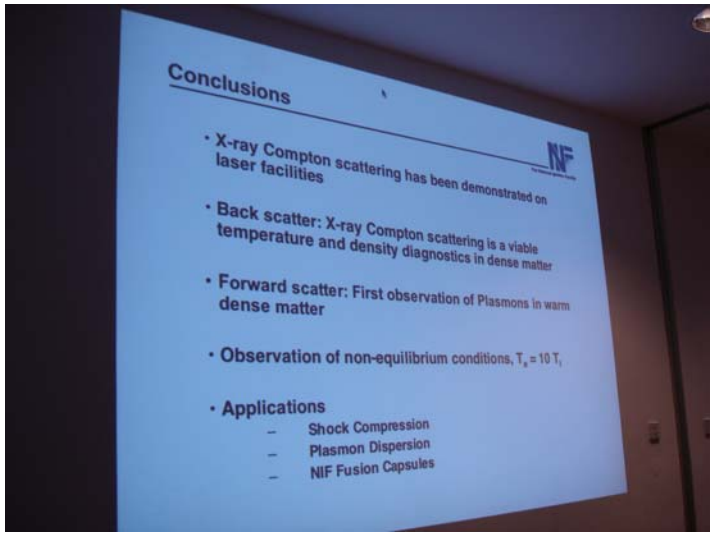


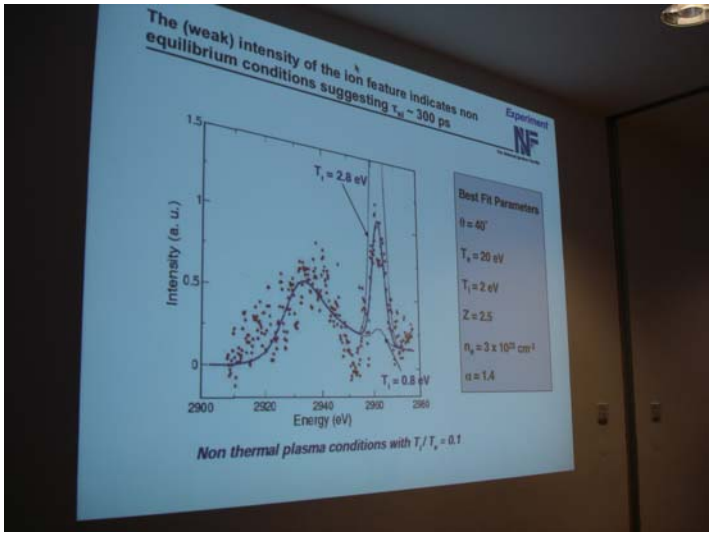
→ *I gave copies of this talk to Wim Leemans (LBNL), because this could become a breakthrough method for 5th generation light sources*

Siegfried Glenzer (LLNL-NIF) finds a surprise with forward scattered x-rays: highly non-equilibrium Ti <<Te in solid density Beryllium





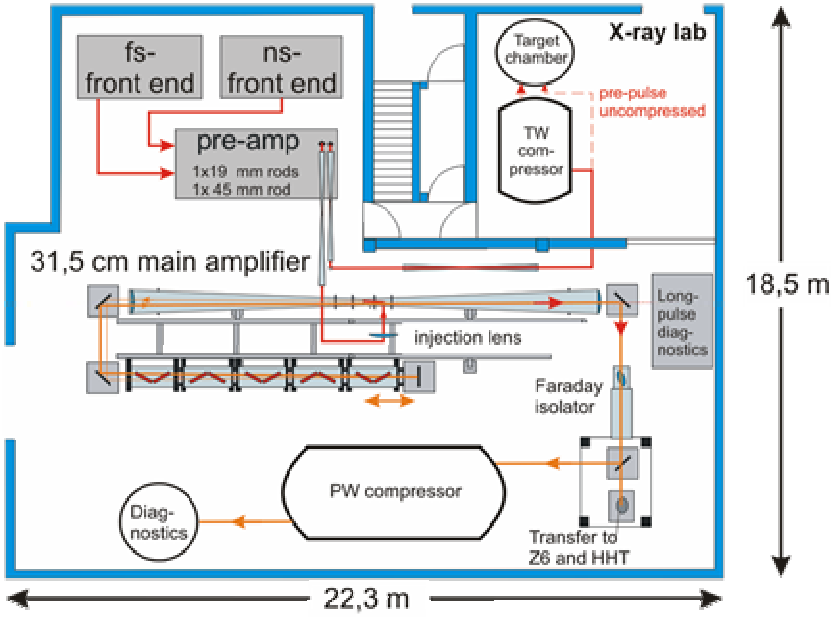




PHELIX Performance in the Laser Bay and First Experiments (Witte)

Beam parameters

- **Beam dimensions 25x28 cm²**
- **Pulse duration 500 fs**
- **Pulse power 300 TW (limited by gratings)**
- **Focal intensity > 10^{20}W/cm²**
- **Contrast >10^5**
- **Pulse energy ~500 J for 10 ns FWHM**



This new GSI laser capability no coming on line was made possible by a loan of Nova 33-cm amplifiers:

- **Originally offered to GSI by Mike Campbell in 1997 at HIF97**
- **Still loan property of LBNL!**
- **Shipped to GSI 2001-2002**
- **To be used for laser backlighter diagnostic dev. at GSI-HHT area for WDM experiments 2007-2008**

First measuring campaign

1. **Sub-10 nm GRIP X-Ray Laser (supported by Laserlab)**
2. **Experiments recommended by PPAC**

Phelix staff we know: Thomas Kuehl, Markus Roth, Andreas Tauschwitz

View of Hirschegg from IFEN

View of IFEN from Waldemar-Petersen Haus

Appreciation of some local cultural differences…..

A German/Austrian style woodpile

Logan's woodpile

(Danville, CA)

Matthaeus must have some relatives in this part of Austria….

Mittelberg from Panaramic Weg

Hirschegg06 conference dinner

L to R: Grant, Boris and his wife Nina Sharkov, Ingrid and Dieter Hoffmann

- They want me to restore Hirschegg07 accelerator vs laser talk balance with more heavy ion beam related topics
- They want to see ~ 5 new US faces next year